

CELL CYCLE & CELL DIV SUMMARY SHEET:-

- Cell division is of two types → mitosis & meiosis.
- The DNA in prokaryotes is only double stranded circular DNA attached to the inside of cell membrane.
- Eukaryotes store genetic information in chromosome.

Mitosis

Mitosis:- (Flourishing and the turn)

- Mitosis has two stages:-
 - Interphase (growth phase)
 - Karyokinesis & cytokinesis (div. phase)

a) Interphase:- (Occupies 95% of cell cycle)
 ↳ cell is most active metabolically in interphase.
 It is divided into three parts.

i) G₁ phase - All raw material for spore is (12 hrs) synthesized
 • no. of organelles increases
 • Proteins such as DNA polymerase, Non-histone protein, histone proteins are synthesized.

ii) S phase - Replication of centrioles occurs. (6-8 hrs)
 • DNA content doubles but chromosome no. remains same.

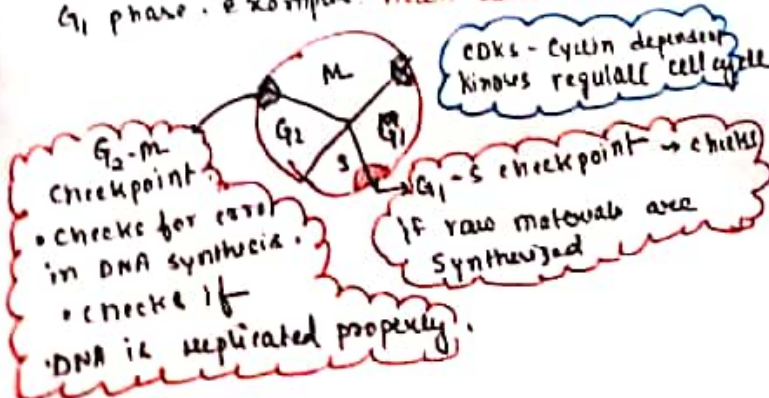
Chromosomes

88 $\xrightarrow{\text{S phase}}$ 176
 $2n = 2$ $2n = 2$

iii) G₂ phase - Massive production of tubulin occurs which gives rise to spindle apparatus. (3-4 hours)

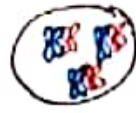
- Replication of centrioles completed.
- Cell size increases.
- However, maximum cell growth occurs in G₁.

• Many cells are metabolically inactive but don't divide and enter G₀ phase after G₁ phase. Examples: heart cells, nervous tissue.



Mitosis

Prophase:



- chromosomes are formed
- nucleus and nuclear membrane disappear.
- centrioles move to opp. poles.
- no. cell organelles observed.
- mitosis in plants is anastrial and mitosis in animal is astral or amphiatral.

Metaphase:



- chromosomes form metaphase plate.
- Discontinuous fibre - have chromosome.
- Continuous fibre - don't have chromosome.
- Mitotic poisons such as colchicine arrest cell division @ metaphase doubling ploidy.

Anaphase:



- chromosomes move to opp. poles.
- centromeres divide and integronal fibres pull chromatids apart while spindle fibres pull the chromatids apart.
- Spindle fibre has 97% tubulin & 3% RNA.

Telophase:



- Sister chromatids @ opposite poles.
 - Spindle disassembles.
 - Nuclear membrane reforms, nucleus reappears.
- NOTE: $N/C \uparrow$ (Nuclear cytoplasmic ratio \uparrow), cell division \uparrow , activity \uparrow
 $SA/V \uparrow$ (Surface area/volume ratio \uparrow), cell division \uparrow , activity \uparrow .

Cytokinesis: In animals forms due to furrow, at the plasma membrane, centripetal.

In animals due to a cell plate formed by Golgi vesicles, ER, remnants of spindle fibres which give rise to cell plate → centrifugal.

Modification of Mitosis

- a) Uncontrolled mitosis → unlimited mitosis leads to formation of tumour.
- Occurs due to cellular oncogenes.

- b) **Promitosis**: Mitosis occurs with all the usual steps of karyokinesis but nuclear membrane does not disintegrate.
 • Found in amoeba.

- c) **Free nuclear division**: - karyokinesis not followed by cytokinesis. Example: endosperm, fungi of phycomycetes group.

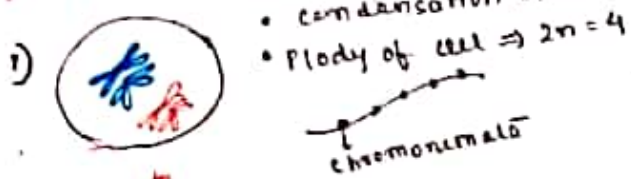
Meiosis

- Referred to as reductional division.
- Chromosome number halves.
- Name proposed by Farmen & Moore.
- Found in gamete forming cells.

Meiosis I → Prophase I:

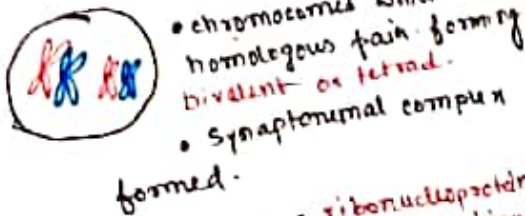
1. **Leptotene**: condensation.
2. **Zygotene**: pairing of homologous chromosome.
3. **Diplotene**: chiasmata clearly visible.
4. **Diakinesis**: ~~terminalization~~ of chiasmata.
5. **Pachytene**: crossing over occurs.

- 1) **Leptotene**: - chromatin network visible as thick threads.



- condensation starts.
- Ploidy of cell $\Rightarrow 2n = 4$

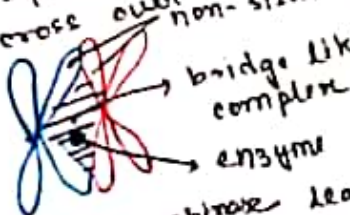
2) Zygotene:



- chromosomes which are homologous pair forming bivalent or tetrad.
- Synaptonemal complex formed.

synaptonemal complex \rightarrow ribonucleoprotein complex made mainly of protein ubiquitin. Synaptonemal complex was first observed in Crayfish by Möhr.

- 3) **Pachytene**: Recombination nodules occur in the synaptonemal complex which lead to cross over non-sister chromatids.



- Enzyme recombinase leads to recombination of parts of chromosomes (genes) between non-sister chromatids to be exchanged.



synaptonemal complex.

- Pachytene stage involves crossing over or exchange of corresponding parts of chromosome between non-sister chromatids.
- It is the longest stage of prophase I.

- Diplotene**: Marked by the dissolution of synaptonemal complex.
- Terminalization starts.
 - Chiasmata appear clearly.

- Diakinesis**: • Terminalization of chiasmata ends.

Anaphase I: metaphase plate of homologous chromosome form.

Anaphase I: - Homologous chromosome move to opposite poles.

Telophase I: - Followed by meiosis 2. Transition phase between meiosis 1 & 2.

- ④ **Meiosis 2**: - Just like mitosis. Equational div.

④ Amitosis \rightarrow Observed by Flemming

- Simplest form of cell div.
- Nuclear material divides into two.
- Cell wall formed.
- Two cells are formed.

